COMBINING SUNRISE AND LUNAR SURFACE INTERFEROMETER OBSERVATIONS OF SOLAR RADIO BURSTS. A. M. Hegedus[1], J. C. Kasper[1], J. O. Burns[2], SunRISE Science Team, [1]Climate and Space Sciences and Engineering, University of Michigan, Ann Arbor, MI (alexhege@umich.edu), [2]Astrophysical and Planetary Sciences, University of Colorado Boulder, Boulder, CO.

Introduction: The Earth's Ionosphere limits radio measurements on its surface, blocking out any radiation below 10 MHz. Valuable insight into many astrophysical processes could be gained by having a radio interferometer in space to image the low frequency window, which has never been achieved. One application for such a system is observing type II bursts that track solar energetic particle acceleration occurring at Coronal Mass Ejection (CME)-driven shocks. A related application is localizing type III bursts during storms to determine the level of magnetic connectivity of the source region on the solar surface. These are the primary science targets for SunRISE, a 6 CubeSat interferometer to circle the Earth in a GEO graveyard orbit. In this work, the SunRISE mission is outlined, with an emphasis on how it could be supplemented with observations from modestly sized lunar radio interferometers.

Observing Solar Radio Bursts: SunRISE is a NASA Heliophysics Mission of Opportunity that just passed its Systems Integration Review, and plans to launch for a 12-month mission in mid-2024. In this work we present an update to the data processing and science analysis pipeline happening at the University of Michigan's SunRISE Science Data System, and evaluate its performance in localizing type II and III radio bursts between 0.1 – 25 MHz from 2 – 20 solar radii. Realistic thermal noise is included, dominated by the galactic background at these low frequencies, as well as new sources of phase noise from positional uncertainty of each spacecraft. Details are presented on the calibration of the radio data, the forming of the synthetic aperture, and the process of localizing the radio emission. Examples of data types produced by the SunRISE mission are outlined to prepare the community for the incoming data. These analyses show that SunRISE will significantly advance the scientific community's understanding of type II burst generation, and consequently, acceleration of solar energetic particles at CMEs. SunRISE observations of type III storms will also show the level of magnetic connectivity of active regions on the solar surface. We also present the added benefit of combining SunRISE observations with 2 or more antenna on the Lunar surface. The data added from Lunar observations would help us reconstruct the sky brightness patterns of larger radio bursts, leading to a better understanding of the phenomena. We find that for highly scattered type III bursts, antenna on the lunar surface with shorter baselines on the order of 100 meters would have cross correlated signals 1000x stronger than those of the longer SunRISE separations between 1-10 km. This would allow localizations of solar radio bursts throughout their entire lifetimes as they grow larger from scattering.